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EFFECTS OF SALINITY ON LARVAL DIMENSION OF *Tilapia guineensis*

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ABSTRACT

Tilapia guineensis eggs were spawned and hatched in different salinities (17, 12, 7, 5, 2 and 0) ppt. The study was conducted in eight replicates. The aim of the investigation was to ascertain disparity in hatching size of Tilapia guineensis attributable to salinity. Immediately hatching was observed, body weight of five hatchlings in each replicate was individually weighed in milligramme. The individual total length of the five hatchlings was also measured in millimeter. The height of the yolk sac larva was determined with micro-metre screw gauge graduated in millimeter from the top of the yolk sac to the dorsal region of the larva. Data obtained were used to calculate yolk sac volume. Significant differences (P<0.01) were observed in body weight and total length of larvae hatched in different salinities. The heaviest and longest larvae were hatched in 12 ppt saline water. The yolk sac volume of larvae hatched in lower salinities were significantly higher (P<0.01) than the yolk sac volume of larvae hatched in higher salinities. The smallest yolk sac volume was recorded in 12ppt saline water. Our findings show that salinity could be manipulated for economic production of heavier seeds of Tilapia.

INTRODUCTION

The effects of salinity on course of embryonic development of many fish species have been discussed by several authors. Bonislawska (2009) reported size differences between larvae of *Salmo trutta* hatched from eggs incubated at different salinities. Vetemaa and Saat (1996) found larva of the freshwater *ruffe* to develop regularly when the eggs were incubated at 1 to 6ppt salinities. The embryos developing from eggs of the Baltic bay *ruffe* were more salinity tolerant as normal individuals hatched from eggs incubated at 7, 8 and 9 ppt and their maximum body length was always attained at salinity higher than the eggs of freshwater *ruffe*. Albert *et al* (2004) reported that the length of *Coregenous larvaetus moraenoides* free embryos was highest at 2.1 ppt. However, Kucera *et al* (2002) reported no significant difference in size at hatch of *Cynoscion nebulosus* larva in 20 ppt and 40 ppt salinities. Bonislawska (2009) observed that depending on the water salinity, the newly hatched larvae of Sea trout (*Salmo trutta*) showed significant differences in length and weight. The longest and heaviest larva hatched from 0 ppt and those incubated in the low salinities. Swanson (1996) reported that the newly hatched larvae of *Chanos chanos* differed in their size parameters within the range of 15 to 55 ppt. Those larvae developing at optimum salinity (35 ppt) were the longest and their yolk sacs were the smallest. The study reported here, presented the effects of salinity on the size of the newly hatched larvae of *Tilapia guineensis*. Salinity effect on hatching size could be utilized in economic production of heavier seeds of *Tilapia guineensis.*

MATERIALS AND METHODS

Adult male and female *Tilapia guineesis* of relatively uniform sizes were paired for spawning in 17, 12, 7, 6, 5, 2 and 0 ppt salinities. 12, 7, 6, 5, and 2 salinity ranges were obtained by diluting high salinity (17 ppt) with 0ppt (non saline) rain water. Salinity was checked with handheld Refractometer (Atago S/Mill-E, Japan). All hatching vats were kept under the same condition of natural photoperiod and light illumination. The hatching trials were replicated in eight places for each treatment. Immediately hatching was observed, total length of five hatchlings were individually measured in each replicate. The total length was sized and read with a pair of divider and metre rule respectively. Total length was measured from the tip of the snout to the end of the caudal fin. The height of yolk sac larva was determined with micro meter screw gauge graduated in mm from the top of the yolk to the dorsal region of the larva. Data obtained were used to calculate the yolk sac volume from the enlongated ellipsoid formula: $V = \frac{\pi}{6}\ 1h^2\ (mm^3)$ (Gisbert *et al* 2000). Where 1 = length of the yolk sac larvae, h = height of the yolk sac. Individual weight of the five hatchlings per replicate was weighed with top load precision electronic balance to the nearest 0.1mg. The hatching water temperature and p^H were monitored using Hannah equipment temperature and p^H metres. Treatment means were analysed employing Analysis of Variance (ANOVA). Two tailed multiple comparison procedure (F-LSD) was used to separate treatment means that differed in the observed probability level as implemented in Obi (1990).

RESULTS

Data obtained showed that the effect of salinity on larval hatching length and weight were highly significant (P<0.01). See tables 1.0 and 2.0. The longest and heaviest larvae were hatched in 12 ppt saline water. However, the length of larvae hatched in 6, 7 and 17 ppt were not significant (P>0.01). Also the weight of larvae hatched in 5, 6, 7 and 17 ppt were not significantly different (P>0.01). The length and weight of larvae hatched within the salinity limit of 0 – 2 ppt were significantly smaller than the length and weight of larvae hatched in higher salinity ranges (5 – 17 ppt).

On the contrary, the yolk sac height and volume of larvae hatched in lower salinities were significantly higher (P<0.01) than the yolk sac height and volume of larvae hatched in higher salinities. The smallest yolk sac height and volume was recorded in 12 ppt saline water (Tables 3 and 4). The yolk sac height and volume of larvae hatched within the salinity ranges of 5 – 17 ppt were not significant (P>0.01). However, the yolk sac height and volume of larvae hatched in 17 ppt were higher than the yolk sac height and volume of larvae hatched in 7 ppt salinity. The effect of salinity on hatchling dimension observed in the study, resemble normal distribution having its peak around 12 ppt salinity. There was no significant difference in the hatching water temperature and p^H (table 5).

DISCUSSION

The salinity limits investigated in this study showed concentration dependent effects on hatching size and yolk sac dimension of *Tilapia guineensis.* The heaviest and longest larvae were hatched in 12 ppt saline water. The yolk sac height and volume of larvae hatched in lower salinities were significantly higher than the yolk sac height and volume of larvae hatched in higher salinities. The shortest yolk sac height and the smallest yolk sac volume were recorded in 12 ppt saline water.

Physiological imbalance may be responsible for the differences observed in the hatching sizes and the yolk dimensions among the treatments. Influx and efflux of salt into embryo due to unfavourable incubation salinity may result in rapid alteration in the embryo's physiology during the early period of the exposure. Such change could affect the hatching and yolk sizes of the embryo.

Swanson (1996), reported oxygen consumption of the milk fish (*Chanos chanos*) to be optimum at 35‰. Consequently, embryos developing at 35‰ were longer than those developing within the salinity ranges 15 – 20‰ and 50 - 55‰. A similar situation was observed in this study. The longest and heaviest larvae hatched with smallest yolk sac from the eggs spawned in the best of all the salinities studied.

Bonilawska (2009) reported that longest and largest larvae of *Salmo trutta* hatched from those incubated at the lowest salinity (0 ppt). The highest salinity (3‰) proved lethal for the developing embryos and hatching did not occur. On the other hand, salinity of 2 ppt did not stop hatching, but reduced the size of the newly hatched larvae.

The above findings show that the optimal salinity for hatching heavy and long *T. guineensis* lies around 12 ppt salinity. Distant salinities from 12 ppt may not be favourable enough for hatching best *Tilapia guineensis* in terms of size. Salinity could therefore be manipulated for economic production of heavy and long seeds of *Tilapia guineensis*

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Table 1.0: Total Length of *T. guineensis* hatchling in different salinities

Salinity				**Replicates**					**Mean**
17	5.20	4.68	5.02	4.70	4.58	4.86	5.02	4.92	4.8725[ab]
12	5.40	4.70	5.20	4.80	4.90	5.10	5.00	4.90	5.0000[a]
7	5.20	4.80	4.90	4.60	4.60	5.00	5.10	4.60	4.8500 [ab]
6	4.92	4.78	4.90	4.70	4.70	4.90	5.00	4.60	4.8050[b]
5	4.70	4.70	4.90	4.80	4.40	4.60	4.90	4.70	4.7125[b]
2	4.30	4.20	4.30	4.80	4.20	4.40	4.22	4.36	4.3475[c]
0	4.26	4.40	4.50	4.80	4.00	4.20	4.32	4.12	4.3250[c]

Means not followed by the same letter are significantly different at 1% level of probability.

Table 2.0: Body Weight of *T. guineensis* hatchling in different salinities

Salinity				Replicates					Mean
17	2.86	2.80	2.64	2.44	2.72	2.68	2.56	2.60	2.66[a]
12	2.92	2.84	2.72	2.56	2.76	2.76	2.52	2.76	2.73[a]
7	2.82	2.82	2.64	2.44	2.72	2.80	2.44	2.76	2.68[a]
6	2.81	2.84	2,64	2.40	2.76	2.60	2.46	2.74	2.66_a
5	2.86	2.82	2.62	2.48	2.60	2.48	2.54	2.74	2.64[b]
2	1.92	1.92	1.90	1.96	1.90	1.88	1.876	1.92	1.91[b]
0	1.96	1.96	1.92	1.88	1.l88	1.88	1.88	1.84	1.91[b]

Means not followed by the same letter are significantly different at 1% level of probability.

Table 3.0: Height (mm) of yolk sac larvae hatched in different salinities

Salinity	Replicates							Mean
17	0.29	0.27	0.27	0.25	0.27	0.20	0.24	0.25	0.255[b]
12	0.28	0.26	0.26	0.22	0.23	0.20	0.22	0.22	0.236[b]
7	0.28	0.26	0.28	0.24	0.27	0.22	0.24	0.24	0.254[b]
6	0.30	0,27	0.27	0.25	0.25	0.23	0.24	0.25	0.258[b]
5	0.29	0.27	0.29	0.25	0.27	0.19	0.25	0.25	0.258[b]
2	0.30	0.32	0.31	0.30	0.32	0.35	0.31	0.31	0.315[a]
0	0.31	0.34	0.33	0.32	0.34	0.30	0.32	0.32	0.323[a]

Means not followed by the same letter are significantly different at 1% level of probability.

Table 4.0: Volume (mm^3) of yolk sac larvae hatched in different salinities

Salinity	**Replicates**								**Mean**
17	0.23	0.18	0.19	0.15	0.17	0.10	0.15	0.16	0.17[b]
12	0.22	0.17	0.18	0.12	0.13	0.10	0.12	0,17	0.15[b]
7	0.21	0.17	0.20	0.14	0.17	0.13	0.15	0.14	0.16[b]
6	0.23	0.18	0.19	0.15	0.15	0.13	0.15	0.15	0.17[b]
5	0.21	0.18	0.21	0.16	0.17	0.09	0.16	0.15	0.17[b]
2	0.20	0.22	0.21	0.22	0.22	0.28	0.21	0.22	0.22[a]
0	0.21	0.26	0.25	0.26	0.24	0.20	0.23	0.22	0.23[a]

Means not followed by the same letter are significantly different at 1% level of probability.

Table 5.0: Water quality Temperature and P^H Values observed among the replicates.

				Temperature (°C)					
Salinity				**Replicates**					**Mean**
17	28	28	28	28	28	28	28	28	28
12	28	28	28	28	28	28	28	28	28
7	28	28	28	28	28	28	28	28	28
6	28	28	28	28	28	28	28	28	28
5	28	28	28	28	28	28	28	28	28
2	28	28	28	28	28	28	28	28	28
0	28	28	28	28	28	28	28	28	28
				pH					
17	7.5	7.5	7.5	7.6	7.6	7.5	7.6	7.6	
12	7.5	7.5	7.6	7.6	7.5	7.6	7.7	7.6	
7	7.5	7.6	7.6	7.7	7.7	7.6	7.6	7,6	
6	7.5	7.6	7.6	7.6	7.6	7.7	7.7	7.6	
5	7.7	7.7	7.6	7.6	7.6	7.7	7.7	7.6	
2	7.8	7.7	7.7	7.6	7.6	7.7	7.7	7.8	
0	7.8	7.8	7.7	7.8	7.6	7.7	7.7	7.7	

CONCLUSION

Tilapia guineensis can hatch in wide salinity range of 0 – 17 ppt as observed in the present study. However, the hatching salinities could affect the hatchling size and yolk dimension of the hatched larvae. We observed that the optimal salinity for hatching best *T. guineensis* in terms of size lies around 12 ppt salinity. Manipulation of salinity could therefore be employed for economic production of heavy *Tilapia guineensis.*

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